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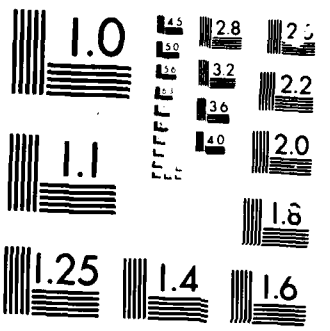

MICROCOPY RESOLUTION TEST CHART

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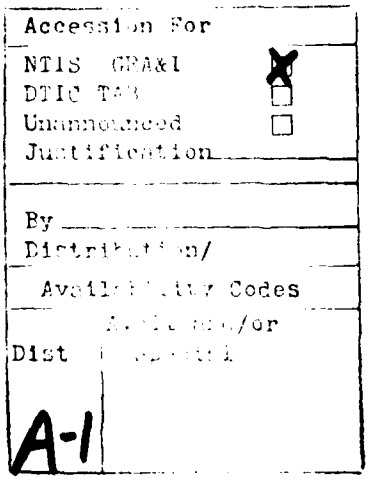

FIREWORKS IN SPACE

Fireworks bring about brightness, energy and power. Of course, there is much more it can give, depending on the specific condition.

On important holidays or at significant ceremonies, fireworks are ignited and launched into the sky one after another, at the cheers of crowds, leaving behind them myriads of golden trails. What a beautiful spectacle to behold!

Inspired by fireworks, our ancestors invented rockets. From then on, the principle of recoil was applied to the military use whereby it showed extraordinary power as depicted by the ancient book, "Booming cannons, deafening sound of gongs and drums, flying arrows were everywhere all of a sudden", which was the picture of the battle in which the army of the Song Dynasty were fighting against their enemy. Under such a sudden and strong attack, the enemy collapsed without even a battle.

The fundamental operation of the rockets in the ancient times was ignition. To light fuses, it was necessary to use light and a rolled paper medium. Modern rockets, however, are not associated with the use of light and the rolled paper medium. The starting of an engine in a rocket, nevertheless, is still called ignition. Ignition, ancient and plain as it is as a word, still remains in the vocabulary of modern astronautics.

The ignition of rockets (including the carrier rocket which is responsible for carrying a satellite into space) is conducted by a special starting device. The operating principle is to light with electricity the propellant of the engine in a rocket, putting the engine in a working condition so as to product thrust, and push it into space. At the order for ignition from a commander, the multistage rocket which carries a communication satellite starts soaring up into the sky, the whole Earth being shaken.

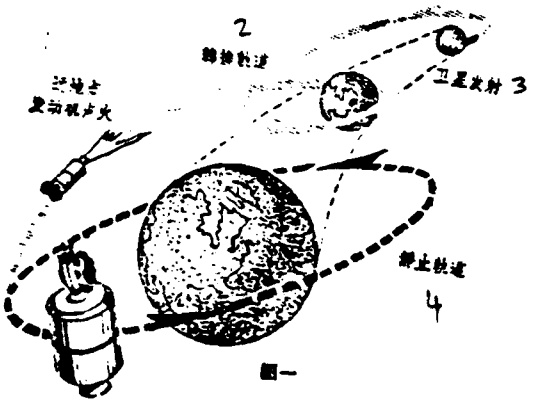

Figure 1
1--the ignition of the engine at the apogee; 2--the transfer of orbits; 3--the launch of satellite; 4--the static orbit

Supposedly, it is at night, the hot trail of flame spurting out of the rocket lights the whole sky so brightly that it looks as if it were daylight, the surrounding mountains and rivers being so beautifully decorated.

Once the rocket gets ignited, all the composite sub-rockets start operating and with the propellant of each rocket used up, they automatically fall off from the main body. The satellite and the rocket disconnect from each other with the last rocket propellant burned up. By now, having been accelerated repeatedly, the speed and height of the satellite have reached the degree desired and now enter a large oval-shaped transfering orbit. The apogee of the transferring orbit is about 36,000 km and the perigee of the transferring orbit about several kilometers. The satellite moves in the transferring orbit in order to prepare to shift into the round synchronous orbit 36,000 km high above the Equator. The transfer of the satellite from the transferring orbit into the synchronous orbit is an essential mechanical operation. Such a usual process of flight, however, will not be possible without the ignition.

Although a satellite needs only to move around the transferring orbit several times, such an action is regarded as highly important because of a series of complicated mechanical operations which must be completed during the process. The survey control system on the ground at the same time must keep close and accurate survey and control on the orbit and operating condition of the satellite in order to establish the "best possible condition for ignition". The ignition mentioned herewith indicates the ignition in space by the apogee engine carried by the communication satellite. The apogean engine is a compact yet powerful rocket specially made for

such a mission. The engine conducts the ignition. At the apogee of the transfer orbit. Once ignited, the satellite is propelled to depart from the transfer orbit to the synchronous orbit about 36,000 km away from the Equator of the Earth (see Figure 1).

The track of the orbit in the apogee in which the ignition is conducted is called the "ignition track". Suppose the operation of the satellite is a play, the track for ignition is the dramatic climax. The ground control must start several hours in advance so as to prepare to direct the operation of the satellite. At the same time, in the survey-control center, the engineers who design and are now in control of the apogee engine watch closely any display appearing on the screen, waiting for the final judgement of history on the fruit that they have cultivated for a long time. Under the leadership of a commander, with information collected from all the experts working in the survey-control center, the best possible condition for ignition is confirmed. The ignition in space is decisively important because it is different from the ignition of ordinary rockets. Such ignition is conducted in space about 36,000 km away from the Equator of the Earth. So if it fails, the satellite will keep moving around in the transfer orbit until it eventually falls apart. If, on the other hand, the time or the position of the ignition is inaccurate, it can cause the expensively built satellite to dart, like a run-away horse, astray into the boundless space, or being less serious, to deviate from the schedule orbit to correct (which requires excessive fuel and consequently shortens the service life of the satellite). The ignition in space is made possible with comprehensive technology. It is conducted by computers, miraculous software, radiowaves and, in short, human wisdom combined with energy. Though ignition takes only a fraction of a minute, to prepare for such a minute it involves countless tests and experiments conducted on the ground with many of the same engines as used in a satellite. Just like rehearsing a play, engineers on the ground program the whole process all year round, with many sleepless nights. During the preparation any mistake made can cause the failure of the whole plan.

Now comes the moment for the ignition, at the order of the commander, the engineer at the main control center pushes the button on a computer which immmediately supplies a series of codes to be transformed into radio signals by the control system and sent into space in the form of paraboloid. Meanwhile, upon receiving the direction, the remote-control system in the satellite starts the ignition of the engine at the apogee. The satellite which stays in orbit starts transferring into the synchronous orbit. Now the orbit transfer is successfully completed.

On April 8, 1984, China successfully launched an experimental communications satellite. Two days later, the ignition in space at the apogee was conducted with success. These exciting moments will be recorded in the history of astronautics of our country. For the first time in history, China has her own self-built and self-launched synchronous satellite.

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